VEHICLE SEAT WITH SUPPORT FOR THE LOWER LEGS

FIELD OF THE INVENTION

The present invention relates to a vehicle seat.

BACKGROUND INFORMATION

German Published Utility Model No. 92 00 777.5 illustrates a bus seat with a footrest. The footrest is coupled to the seat cushion of the bus seat via a parallelogram linkage mechanism. A gas-filled spring interacts with the parallelogram linkage mechanism in order to swing the footrest from a stowaway position arranged below the seat cushion into a position of use. The position of the footrest cannot be set in a variable manner, and so this seat does not provide a very comfortable sitting position for very tall or very short people.

German Published Patent Application No. 27 47 592 describes a vehicle seat which is mounted displacably in a rail in a vehicle. The vehicle seat can be moved in the rail via an electric motor. In order to prevent the driving motor from being damaged if the seat should be blocked, the driving motor has a sliding clutch which disengages the driving motor in the event of overload.

SUMMARY

An example embodiment of the present invention may provide a vehicle seat which may be of compact design and may have a comfortable sitting position and a comfortable relaxing position, may be simple to operate and may have great reliability against incorrect operation.

The vehicle seat has a lower leg support which may be moved from a stowaway position into a position of use and may be fixed in a freely selectable position. The lower leg support has an overload safeguard which releases the fixation of the

lower leg support in the event of overload, thereby allowing the lower leg support to give way. Damage to the lower leg support as a consequence of incorrect operation may therefore be largely prevented.

A comfortable vehicle seat should provide good leg support in the relaxing position. The legs may be supported over their entire length. The vehicle seat therefore has a lower leg support having, e.g., a continuous supporting surface. The lower leg support is fastened pivotably to the seat cushion or to a seat frame of the seat cushion. The inclination and/or length of the lower leg support may be adjusted in an automatically driven manner. It may therefore be possible for people of different heights to set a comfortable sitting position matching their height.

In the relaxing position, the lower leg support may reach a long way into the footwell and may have a long lever arm. If, during the automatic adjustment, the footrest is moved against an obstacle or a great force is exerted on the footrest, e.g., by a person standing on the footrest or by heavy objects being deposited thereon, a correspondingly large force therefore acts on the securing device of the footrest. If the force is large enough, the vehicle seat may be damaged. The overload safeguard limits the force to, e.g., a presettable value.

The overload safeguard may trigger if the lower leg support is subjected to loads on both sides. It is thus possible for a downwardly directed overload to be caused, e.g., by heavy objects deposited on the lower leg support. Following a response of the overload safeguard, the lower leg support may drop away downwardly as far as the vehicle floor. An upwardly directed force may act on the lower leg support, e.g., when the lower leg support is automatically lowered as a consequence of an obstacle, for example, a piece of luggage arranged under the lower leg support. The triggering of the overload safeguard limits this force to a maximum value which

EV 323 027 472 US

is dimensioned such that the remaining force may not cause any damage to the lower leg support and/or to the vehicle seat.

It is possible to use the vehicle seat in passenger vehicles, buses and in watercraft or rail vehicles, etc. The vehicle seat may be provided as a comfortable passenger seat in airplanes.

According to an example embodiment of the present invention, a vehicle seat includes: a seat cushion; and a lower leg support pivotably fastened to the seat cushion, infinitely variably moveable between a stowaway position and a position of use and fixable in a freely selectable position. The lower leg support may include an overload safeguard device configured to release fixation of the lower leg support in response to an overload to allow the lower leg support to give way in response to the overload.

The vehicle seat may include an inclination-adjustment device. The lower leg support may be pivotably connected to a frame of the seat cushion by the inclination-adjustment device.

The inclination-adjustment device may be configured as self-locking, and the overload safeguard device may be arranged to interact with the inclination-adjustment device to release the self-locking of the inclination-adjustment device in response to the overload to allow the lower leg support to pivot freely in response to the overload.

The inclination-adjustment device may include a driving motor, e.g., an electric driving motor, arranged to pivot the lower leg support.

The overload safeguard device may include two disks that are acted upon by a spring, that are frictionally connected and that are rotationally fixedly connected to each other, and the

EV 323 029 472 US

rotationally fixed connection of the two disks may be releaseable in response to the overload.

The two disks may be arranged parallel to each other and may be arranged one behind another on a shaft, and each disk may include a toothing arranged on a side surface and arranged to engage the toothing of the other disk.

The toothing of each disk may be arranged in an encircling manner on the side surface of the disk.

The toothings of the disks may be asymmetrical, and the disks may be configured to engage with each other only in a defined position of the disks with respect to each other.

The overload safeguard device may include a spring, e.g., a disk spring, configured to press the disks against each other with a spring force, and the toothings may include teeth having at least one, e.g., two, beveled flank arranged to push the disks apart counter to the spring force when a torque is introduced into the overload safeguard device.

The vehicle seat may be configured as a rear vehicle seat.

According to an example embodiment of the present invention, a vehicle seat includes: seat cushion means; and lower leg support means pivotably fastened to the seat cushion means, infinitely variably moveable between a stowaway position and a position of use and fixable in a freely selectable position. The lower leg support means may include an overload safeguarding means for releasing fixation of the lower leg support means in response to an overload to allow the lower leg support means to give way in response to the overload.

Further features and aspects of the vehicle seat are described below with reference to the appended Figures. The features and combinations of features which are mentioned above and are

EV 323 027 472 US

explained below may be used not only in the respectively indicated combination, but also in other combinations or on their own.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates a vehicle seat with the lower leg support in a position of use.

Figure 2 illustrates the lower leg support with an automatic inclination adjuster in the stowaway position and in a position of use.

Figure 3 illustrates the inclination adjuster with an overload safeguard.

Figure 4 is a schematic view of an overload situation.

Figure 5 illustrates a disk of the overload safeguard.

DETAILED DESCRIPTION

Figure 1 illustrates a vehicle seat 1. It has a backrest 11 with head restraint 12 and a seat cushion 2 with a lower leg support 3. The vehicle seat 1 is mounted in a vehicle, e.g., in the rear of a passenger vehicle, in a manner such that it may be displaced via rails 14. A belt retainer 13 for a three-point belt is integrated in the backrest 11. The backrest 11 and the seat cushion 2 each have padding together with an upholstery fabric, e.g., leather. The seat cushion padding 21 upholsters the seat cushion 2 and the lower leg support 3 and is of continuous design. On its upper side, it forms a cohesive, padded seat surface which extends from the seat cushion 2 as far as the lower leg support 3.

In the relaxing position or position of use which is illustrated in Figure 1, the lower leg support 3 is deployed forward. It has been pivoted and extended forwardly and upwardly in order to enlarge its supporting surface for the

EV 323 027 472 US

lower legs. One end of the lower leg support is mounted pivotably on the seat cushion 2 or on a seat frame of the seat cushion 2 while the other end reaches a distance into the footwell. The seat cushion 2 together with the lower leg support 3 forms an approximately horizontally arranged, continuous supporting surface for the legs of the seated person.

The lower leg support 3 has a three part telescope with an upper telescopic element 32, a central telescopic element 33 and a lower telescopic element 34. In order to vary the length of the lower leg support 3, the telescopic elements 32, 33, 34 may be telescoped via an electric drive. A footrest 4 is arranged at the lower end of the lower leg support 3. The footrest is connected to the lower telescopic element 34 and has a foot plate 41, which is mounted on a crosspiece, is swung out into the position of use and may provide a comfortable support for the feet. The foot plate 41 may be pivoted about an axis of rotation extending transversely with respect to the lower leg support 3, and is approximately perpendicular with respect to the lower leg support 3 in the position of use. One end of the lower leg support 3 is connected to the seat cushion 2. The inclination of the lower leg support 3 relative to the seat cushion 2 may be set via an inclination adjuster 5 having an electric driving motor 51. The other end of the lower leg support may be moved freely and supports the footrest 4.

In addition to the relaxing or reclining position illustrated in Figure 1, the vehicle seat 1 has further sitting positions, e.g., also an upright sitting position with the lower leg support 3 retracted and the footrest 4 swung in.

Figure 2 illustrates the lower leg support 3 firstly in a stowaway position with retracted telescope 32, 33, 34 and secondly in a position of use with extended telescope 32, 33, 34. The lower leg support 3 is connected pivotably to the

EV 323 027 472 US

seat cushion 2 via an electrically driven inclination-adjusting device 5. The inclination-adjusting device 5 is arranged at the upper end of an upper telescopic element 32. It has a driving motor 51 which pivots the lower leg support about the axis of rotation 52, which extends through the inclination adjuster 5, via a self-locking gear mechanism.

The lower leg support 3 has a three-part telescope with an upper telescopic element 32, a central telescopic element 33 and a lower telescopic element 34. The foot plate 41 is fastened pivotably to the lower telescopic element 34. The telescopic elements 32, 33, 34 are arranged and dimensioned such that they may largely be driven one inside another, with the uppermost telescopic element 32 accommodating the others. The lower leg support 3 therefore may require only a small storage space in the stowaway position and at the same time has a large usable length in the position of use. The upper telescopic element 32 has laterally arranged guides which secure the slide 31. The upper side of the slide 31 that faces the seat padding 21 has fittings for attaching the seat padding 21.

The inclination-adjusting device 5 is illustrated in Figure 3 in a perspective view. It has a shaft 53 having an overload safeguard 6. The overload safeguard has two disks 61, 62 which are arranged parallel to each other on the shaft 53 and such that they rest directly on each other. They are accommodated in a housing and are acted upon by a disk spring. The disk spring presses the disks against each other. The first disk 61 is connected in a rotationally fixed manner to the driving motor 51, and the second disk 62 is connected in a rotationally fixed manner to the shaft 53 of the inclination adjuster. Via an intermeshing toothing 63, which is formed on the opposite sides of the disks 61, 62 and is illustrated in Figure 5, the disks 61, 62 have a frictional connection, with the result that the torque produced by the driving motor 51 is

EV 323 029 472 US

transmitted via the disks 61, 62 to the shaft 53 in order to pivot the lower leg support 3.

The toothing 63 is arranged in an encircling manner around both disks and is configured such that the toothing 63 of the first disk has a complementary shape to the toothing 63 of the second disk 62. The two toothings 63 of the disks 61, 62 mesh together in a form-fitting manner acted upon by the disk spring. The teeth 64 of the toothing 63 are arranged such that they taper conically, with the result that their flanks or side surfaces 65 are beveled on both sides of a tooth 64.

If a torque is transmitted via the disks 61, 62, the oblique side surfaces 65 are mutually supported and push the disks 61, 62 apart counter to the spring force of the disk spring. If the torque which is to be transmitted exceeds a certain threshold, then the toothings become disengaged, so that the disks 61, 62 no longer have a frictional connection. The lower leg support 3 may then be freely pivoted. The maximum torque which may be transmitted via the overload safeguard 6 may therefore be limited. The amount of torque which may be transmitted at a maximum may be set by coordinating the spring force of the disk spring and the angle of the side surfaces 65.

The overload safeguard is arranged such that the disks 61, 62 may come into engagement only in a defined position with respect to each other. The isogonality of the lower leg support 3 may therefore be ensured, e.g., for an electronic control. For this purpose, the toothing 63 has asymmetrical shaped fitting marks 66. It may therefore be ensured that, when the overload safeguard is triggered in a certain position of the lower leg support 3, the latter may move away in the direction of the force. After the application of force is removed, the lower leg support 3 may have to be brought manually back into the starting position. Only in this

EV 333 027 472 US

starting position may it be possible for the overload safeguard to snap into place.

Figure 4 schematically illustrates an overload situation as may occur in practice as a consequence of incorrect operation. The lower leg support 3 is arranged in a position of use and supports the lower leg of a seated person. The seat cushion 2, which is connected to the lower leg support via the overload safeguard 6, supports the thighs of the seated person. The seated person presses his foot against the swung-out foot plate 41. The force introduced as a result into the lower leg support is illustrated by arrows. The dispersion of the force causes the lower leg support to be pressed downwardly toward the vehicle floor. If, as a consequence of a kick or a crash, the pressing force is too great, the lower leg support may be damaged and/or the seated person may incur injuries. In order to limit the maximum force, the overload safeguard triggers after a certain value of this force. The lower leg support may be pivoted away downwardly and may not be damaged, and/or the maximum force acting on the foot may be limited.

EV 323 027 472 US